A/B Testing – Final Project

Group 15

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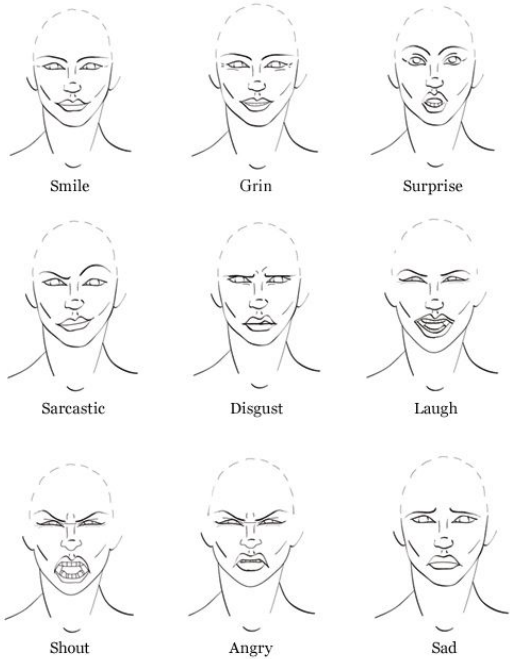
Outline

Introduction

- Human facial expression plays an important role in our daily life.
- There are multiple papers talking about the effect of emotion on advertising engagement, or social media. But only a few studies talk about the effect of emotion on the educational videos.
- **Objective of the experiment:** study the causal effect of presenter's emotion in an educational video on the audience's interest and learning.



Experiment Steps

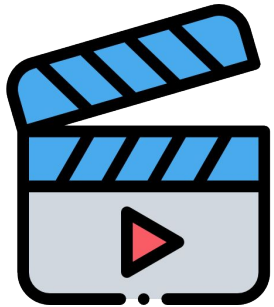
- Create multiple educational videos having different presenters and analyze the facial expressions of presenter in the educational videos, i.e. level of smile (happiness), emotion neutrality, and sadness.

- Distribute a random sample of educational video to the audience (Friends, colleagues, family).

- Post watching the video, ask audience several questions as the baseline and develop a series of questions based on the baseline questions.

- For this project, We are experimenting whether the audience's interest and learning are affected by the presenters facial emotions by running the below regressions:
    - The causal effect of emotion on the participants' self-reported interest scores
    - The causal effect of emotion on the participants' post-quiz scores

Empirical Experimental Setting



23 video explaining
A/B testing

Facial analysis machine
learning model

Gender

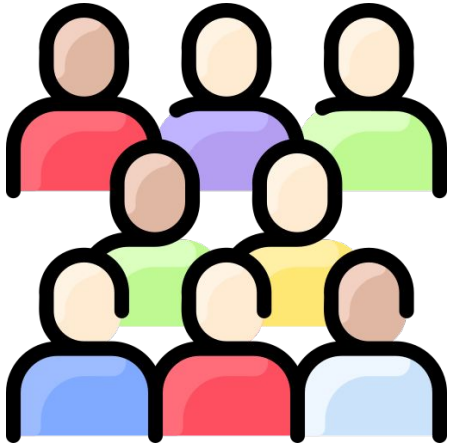
Facial expression

Emotion

Empirical Experimental Setting

1. Take pre-quiz: test level of understanding before watching video
2. Watch video: skipping not allowed
3. Rate interest level: measured on a 7-point Likert scale
4. Take post-quiz: test level of understanding after watching video

Empirical Experimental Setting - Data



Collected data from 241 participants

(13 participants were removed as they didn't watch videos with face shown)

Age

18-24: 92

25 or above: 149

Gender

Female: 99

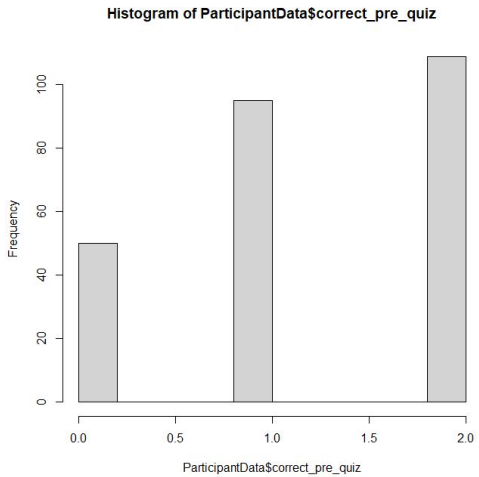
Male or other: 142

Education

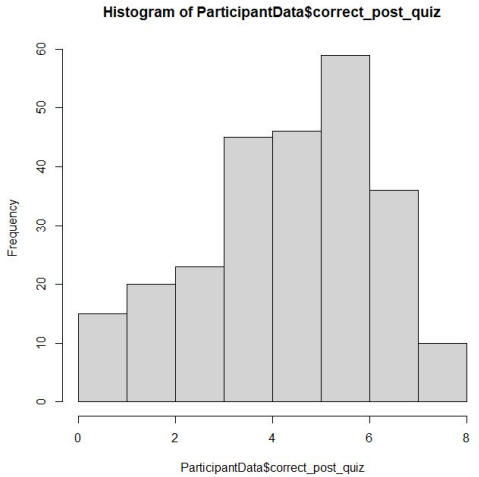
Bachelor's degree or below: 116

Master's degree or above: 125

Empirical Experimental Setting - Data



Pre-quiz score distribution

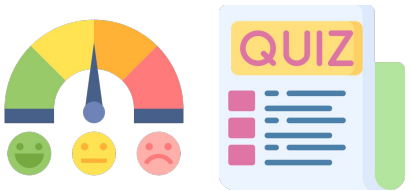


Post-quiz score distribution

Empirical Experimental Setting - Regressions

Smile / Neutral emotion / Sadness of presenter

Causal effect?



Interest level / post-quiz score of participant

Empirical Experimental Setting - Regressions

Covariates:

- *median_smile / median_neutral / median_sadness*: median emotion intensity for the duration of a video
- *self_interest*: participant self reported level of interest
- *correct_post_quiz*: number of questions answered correctly for the post quiz

Heterogeneous effect:

- Age (*demo_age*), gender (*demo_gender*), education level (*demo_education*)

Other variables:

- Interest level regressions: *demo_industry*, *demo_age*, *demo_gender*, *demo_race*, *demo_education*, *demo_income*, *demo_employment*, *demo_country*
- Post-quiz score regressions: *correct_pre_quiz*, *demo_industry*

Results - Causal effect of emotion on interest level

Hypothesis:

- higher intensity of smile leads to higher level of interest
- higher intensity of neutral / negative emotion leads to lower level of interest

Conclusions:

- Coefficient of emotions are statistically insignificant
- Could not establish causal relationship

	Dependent variable:		
	self_interest		
	(1)	(2)	(3)
median_smile	0.937		
	(0.668)		
median_neutral		-0.815	
		(0.619)	
median_sadness			-10.897
			(7.950)
Constant	3.123**	3.969**	3.548**
	(1.535)	(1.570)	(1.520)
Observations	241	241	241
R2	0.375	0.374	0.374
Adjusted R2	0.090	0.089	0.090
F Statistic (df = 75; 165)	1.318*	1.313*	1.317*
Note:	*p<0.1; **p<0.05; ***p<0.01		

Results - Causal effect of emotion on interest level

	Dependent variable:		
	self_interest		
	(1)	(2)	(3)
median_smile	1.157	0.748	0.482
	(1.026)	(0.920)	(0.887)
I(gender_group)	0.072		
	(0.279)		
I(age_group)		-0.424	
		(0.899)	
I(education_group)			0.797
			(0.932)
median_smile:I(gender_group)	-0.372		
	(1.311)		
median_smile:I(age_group)		0.409	
		(1.367)	
median_smile:I(education_group)			1.018
			(1.303)
Constant	3.007*	3.132**	3.186**
	(1.553)	(1.539)	(1.539)
Observations	241	241	241
R2	0.375	0.375	0.377
Adjusted R2	0.085	0.085	0.088
F Statistic (df = 76; 164)	1.295*	1.295*	1.306*
Note:	*p<0.1; **p<0.05; ***p<0.01		

	Dependent variable:		
	self_interest		
	(1)	(2)	(3)
median_neutral	-1.027	-0.340	-0.445
	(0.961)	(0.862)	(0.858)
I(gender_group)	-0.271		
	(1.110)		
I(age_group)		0.495	
		(1.398)	
I(education_group)			1.542
			(1.369)
median_neutral:I(gender_group)	0.358		
	(1.241)		
median_neutral:I(age_group)		-1.003	
		(1.266)	
median_neutral:I(education_group)			-0.772
			(1.236)
Constant	4.067**	3.489**	3.668**
	(1.642)	(1.685)	(1.646)
Observations	241	241	241
R2	0.374	0.376	0.375
Adjusted R2	0.084	0.087	0.086
F Statistic (df = 76; 164)	1.290*	1.301*	1.296*
Note:	*p<0.1; **p<0.05; ***p<0.01		

	Dependent variable:		
	self_interest		
	(1)	(2)	(3)
median_sadness	-8.746	-11.306	-5.863
	(12.757)	(12.133)	(15.094)
I(gender_group)	0.103		
	(0.275)		
I(age_group)		-0.324	
		(0.894)	
I(education_group)			0.819
			(0.918)
median_sadness:I(gender_group)	-3.480		
	(16.114)		
median_sadness:I(age_group)		0.717	
		(16.013)	
median_sadness:I(education_group)			-6.969
			(17.745)
Constant	3.464**	3.545**	3.584**
	(1.516)	(1.526)	(1.527)
Observations	241	241	241
R2	0.375	0.374	0.375
Adjusted R2	0.085	0.084	0.085
F Statistic (df = 76; 164)	1.292*	1.291*	1.295*
Note:	*p<0.1; **p<0.05; ***p<0.01		

- Coefficient of emotions are statistically insignificant
- Could not establish causal relationship even for subgroups

Results - Causal effect of emotion on learning

Hypothesis:

- higher intensity of smile leads to higher post quiz score
- higher intensity of neutral / negative emotion leads to lower post quiz score

Conclusions:

- Coefficient of emotions are statistically insignificant
- Could not establish causal relationship

	Dependent variable:		
	correct_post_quiz		
	(1)	(2)	(3)
median_smile	0.936		
	(0.597)		
median_neutral		-0.814	
		(0.568)	
median_sadness			-2.294
			(6.920)
correct_pre_quiz	1.181***	1.177***	1.172***
	(0.145)	(0.145)	(0.146)
Constant	2.425***	3.223***	2.526***
	(0.436)	(0.663)	(0.440)
Observations	241	241	241
R2	0.350	0.349	0.343
Adjusted R2	0.275	0.273	0.267
F Statistic (df = 25; 215)	4.634***	4.609***	4.491***
Note:	*p<0.1; **p<0.05; ***p<0.01		

Results - Causal effect of emotion on learning

	Dependent variable:		
	correct_post_quiz		
	(1)	(2)	(3)
median_smile	1.223	0.639	0.923
	(0.938)	(0.867)	(0.798)
I(gender_group)	0.042		
	(0.239)		
I(age_group)		-0.394	
		(0.241)	
I(education_group)			-0.100
			(0.237)
correct_pre_quiz	1.179***	1.178***	1.174***
	(0.146)	(0.145)	(0.147)
median_smile:I(gender_group)	-0.486		
	(1.220)		
median_smile:I(age_group)		0.432	
		(1.239)	
median_smile:I(education_group)			-0.030
			(1.209)
Constant	2.399***	2.647***	2.481***
	(0.460)	(0.457)	(0.455)
Observations	241	241	241
R2	0.351	0.358	0.351
Adjusted R2	0.268	0.277	0.269
F Statistic (df = 27; 213)	4.260***	4.409***	4.264***
Note:	*p<0.1; **p<0.05; ***p<0.01		

	Dependent variable:		
	correct_post_quiz		
	(1)	(2)	(3)
median_neutral	-1.293	-0.292	-0.724
	(0.889)	(0.828)	(0.776)
I(gender_group)	-0.711		
	(1.042)		
I(age_group)		0.408	
		(1.059)	
I(education_group)			0.018
			(1.024)
correct_pre_quiz	1.173***	1.168***	1.168***
	(0.146)	(0.145)	(0.147)
median_neutral:I(gender_group)	0.816		
	(1.159)		
median_neutral:I(age_group)		-0.882	
		(1.180)	
median_neutral:I(education_group)			-0.142
			(1.147)
Constant	3.638***	2.971***	3.201***
	(0.903)	(0.839)	(0.808)
Observations	241	241	241
R2	0.350	0.359	0.350
Adjusted R2	0.268	0.277	0.267
F Statistic (df = 27; 213)	4.256***	4.413***	4.243***
Note:	*p<0.1; **p<0.05; ***p<0.01		

	Dependent variable:		
	correct_post_quiz		
	(1)	(2)	(3)
median_sadness	-6.610	-7.384	3.799
	(11.475)	(11.187)	(11.879)
I(gender_group)	-0.036		
	(0.245)		
I(age_group)		-0.454*	
		(0.248)	
I(education_group)			-0.066
			(0.241)
correct_pre_quiz	1.176***	1.172***	1.175***
	(0.147)	(0.145)	(0.148)
median_sadness:I(gender_group)	6.876		
	(14.615)		
median_sadness:I(age_group)		9.285	
		(14.417)	
median_sadness:I(education_group)			-8.795
			(14.848)
Constant	2.544***	2.755***	2.542***
	(0.463)	(0.456)	(0.462)
Observations	241	241	241
R2	0.344	0.353	0.345
Adjusted R2	0.261	0.271	0.262
F Statistic (df = 27; 213)	4.132***	4.311***	4.159***
Note:	*p<0.1; **p<0.05; ***p<0.01		

- Coefficient of emotions are statistically insignificant
- Could not establish causal relationship even for subgroups

Conclusion

- The causal effect of presenters emotions on interest levels and learning outcomes is not statistically significant for the current set of data. Therefore we are not able to conclude whether the presenters emotions affects the interest levels and learning outcomes or not.
- Reasons for being unable to conclude accurately:
    - Small dataset having only 254 participants.
    - Small data collection period of only 2 weeks.
    - There might be minute effects but due to small sample size we didn't find it.
    - There might be no effect present at all.
- Hence, We would be able to conclude accurately about the effects, If we get more time to collect the data.

Recommendations for follow-up studies

- Increase the data collection period and collect more data in the due course.
- Run these regressions again post having a bigger dataset.

Thank You!